

Patent claims:

1 1. A method for determining the distance between a first
2 and second transmitting and receiving station (1, 2),
3 characterized in that

4 in the first and second transmitting and receiving
5 station (1, 2) a first and second transmission signal (S1,
6 S2) is generated and is transmitted as a series of
7 microwave pulses having a predefined pulse repetition
8 frequency (fp1, fp2) to the respective other transmitting
9 and receiving station (2, 1) and is received thereby in the
10 form of a received signal (E2, E1), said pulse repetition
11 frequencies (fp1, fp2) of the transmission signals (S1, S2)
12 varying according to a predefined differential frequency
13 value (fd),

14 in the first and second transmitting and receiving
15 station (1, 2) first and second points of coincidence (t11,
16 t12,...; t21, t22, ...) are determined, which correspond to
17 those moments in time, when the pulses of the transmission
18 signal (S1, S2) sent by the respective transmitting and
19 receiving station (1, 2) and the received signal (E1, E2)
20 received by the respective transmitting and receiving
21 station (1, 2) coincide,

22 the distance between the transmitting and receiving
23 stations (1, 2) is determined from the distances (tm; x, y;
24 U, D) between the points of coincidence.

1 2. A method according to claim 1, characterized in that a
2 distance of coincidence (tm) corresponding to the time
3 offset between the first and second points of coincidence

4 is determined as a measure of the distance between the two
5 transmitting and receiving stations (1, 2).

1 3. A method according to claim 2, characterized in that
2 information on the second points of coincidence (t_{21} , t_{22})
3 is transmitted via a radio channel from the second
4 transmitting and receiving station (2) to the first
5 transmitting and receiving station (1) and in that the
6 distance of coincidence (t_m) is determined in the first
7 transmitting and receiving station (1) from the transmitted
8 information and from the first points of coincidence (t_{11} ,
9 t_{12}) determined in the first transmitting and receiving
10 station (1).

1 4. A method according to claim 3, characterized in that the
2 transmission of the information on the second points of
3 coincidence (t_{21} , t_{22}) and the transmission of the
4 transmission signals (S_1 , S_2) is performed via different
5 radio channels.

1 5. A method according to claim 1, characterized in that the
2 second transmission signal (S_2) is modulated by frequency
3 keying of its pulse repetition frequency (fp_2) and that a
4 change (t_d), resulting from frequency keying, of the
5 distance (T_d) between the first points of coincidence (t_{11} ,
6 t_{12} , ...) is determined as a measure of the distance between
7 the transmitting and receiving stations (1, 2).

1 6. A method according to claim 5, characterized in that the
2 pulse repetition frequency (fp_2) of the second transmission
3 signal (S_2) is switched at frequency keying between two
4 fixed frequency values (f_{21} , f_{22}), the switch being
5 performed synchronously to the second points of coincidence

6 (t21, t22, ...).

1 7. A method according to claim 6, characterized in that the
2 two fixed frequency values (f21, f22) are specified such
3 that the change from one frequency value (f21) to the other
4 frequency value (f22) causes duplication of the amount of
5 the difference between the pulse repetition frequencies
6 (fp1, fp2) of the transmission signals (S1, S2).

1 8. A method according to claim 6, characterized in that the
2 two fixed frequency values (f21, f22) are specified such
3 that the change from one frequency value (f21) to the other
4 frequency value (f22) causes a reverse counting of the
5 difference between the pulse repetition frequencies (fp1,
6 fp2) of the transmission signals (S1, S2).

1 9. A method according to one of the preceding claims,
2 characterized in that the differential frequency value (fd)
3 is substantially smaller than the pulse repetition
4 frequencies (fp1, fp2).

1 10. A method according to one of the preceding claims,
2 characterized in that the two transmission signals (S1, S2)
3 are modulated for the transfer of data.

1 11. A method according to one of the preceding claims,
2 characterized in that in the transmitting and receiving
3 stations (1, 2) the transmission signal (S1, S2) generated
4 in the respective transmitting and receiving station (1, 2)
5 is converted with the received signal (E1, E2) received by
6 this station by mixing into an intermediate frequency
7 signal (Z1, Z2), that the intermediate frequency signal
8 (Z1, Z2) is converted into a pulsed evaluation signal (D1,

9 D2) by filtering and envelope demodulation and that the
10 temporal position of the pulses of the evaluation signal
11 (D1, D2) is determined as points of coincidence (t_{11} , t_{12} ,
12 t_{21} , t_{22}).

1 12. Use of the method according to one of the preceding
2 claims in a keyless locking system for motor vehicles for
3 determining the distance between a first transmitting and
4 receiving station provided in the motor vehicle and a
5 second transmitting and receiving station provided in a key
6 module.